Tutorial
H-1000-5315-01-A

RENISHAW
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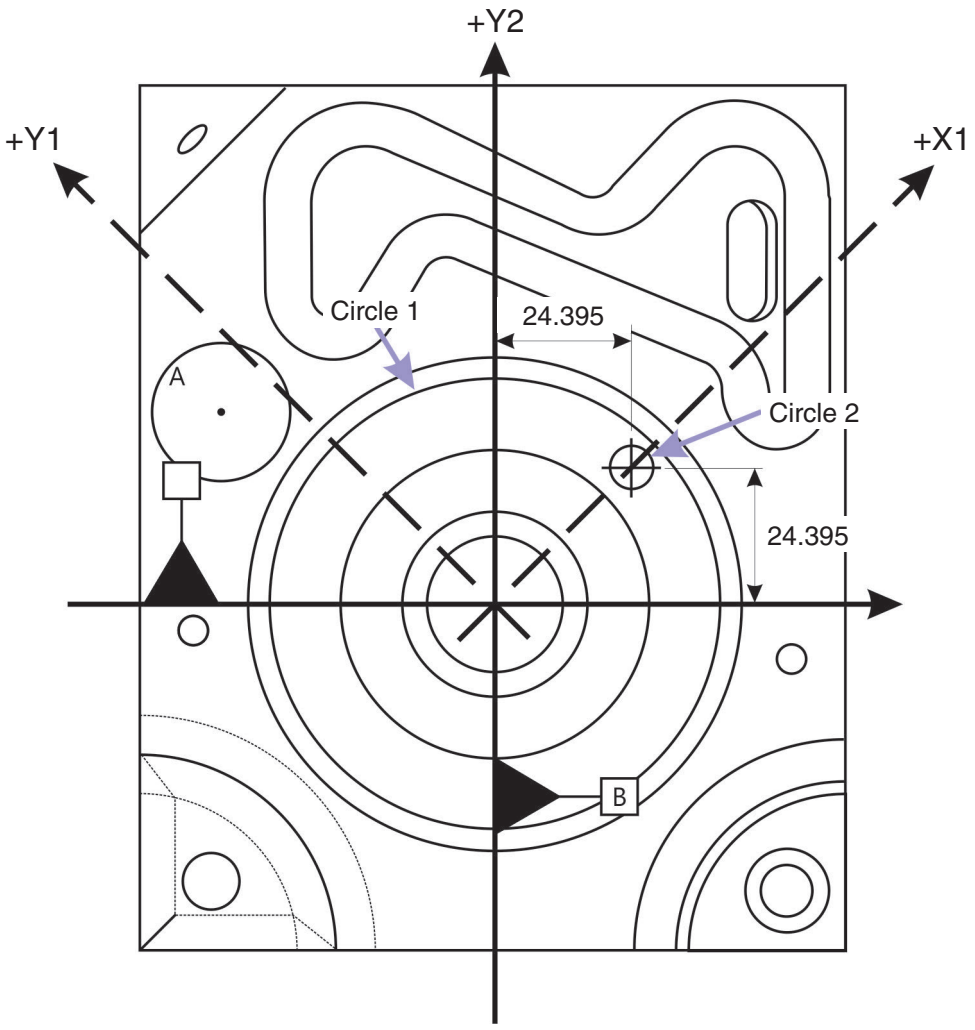
CNC part alignment (non-CAD)



Renishaw part no: H-1000-5315-01-A

Issued: 12 2013

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Contents

1 CNC part alignment (non-CAD)

1.1 Tutorial pre-requisites

- The student should understand the contents of the ‘Principles of part alignment’ tutorial
- The student should have completed ‘Part alignment - plane, line and point’ tutorial and ‘Part alignment - plane and two circles’ tutorial

1.2 Tutorial objectives

- Introduction to the creation of CNC part programs
- Understand CNC machine motion and measurement principles and options
- Further exposure to programming from drawing definition

2 Introduction

The manual alignments that have been covered so far are too crude for good metrology. This is because they don't take enough points and there are significant errors.

However, these rough alignments can be used as a starting point from which more precise alignments can be achieved.

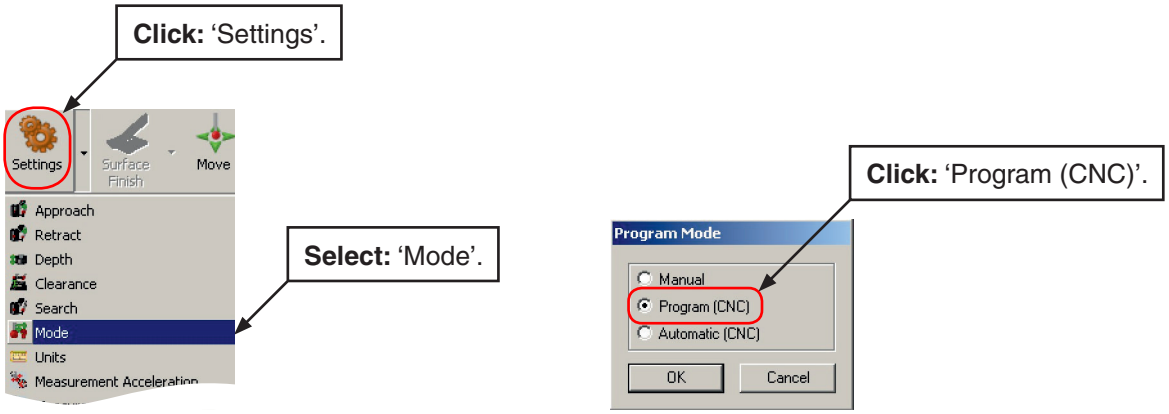
In this tutorial, CNC mode will be used to precisely align the Renishaw training block.

Before starting this tutorial, the component should have been manually aligned as outlined in the 'Part alignment - plans and two circles' tutorial.

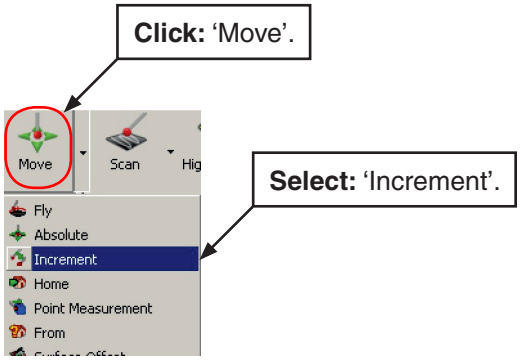
3 Measuring a plane in ‘Program (CNC)’ mode

With a basic manual alignment in place, a more accurate CNC alignment of the component need to be created.

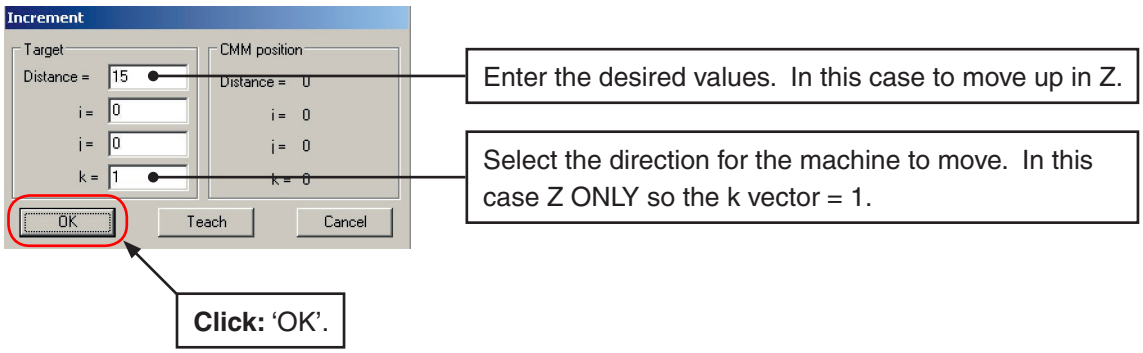
Firstly, the program mode must be set to ‘Program CNC’:

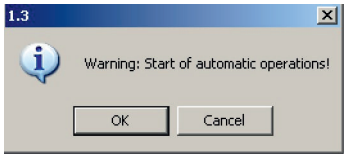


Following the manual alignment, the probe needs to be withdrawn from the last measured feature into a safe location.



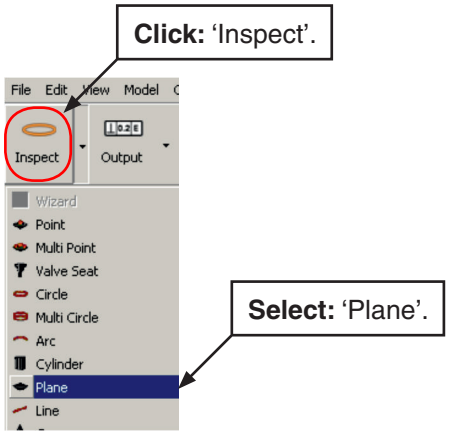
GUIDANCE NOTE: An increment move means the sensor will move a specified distance in the specified direction relative to its current position.

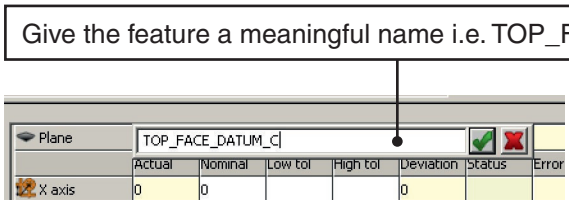




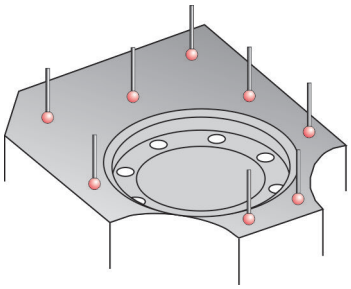
The machine will now move.

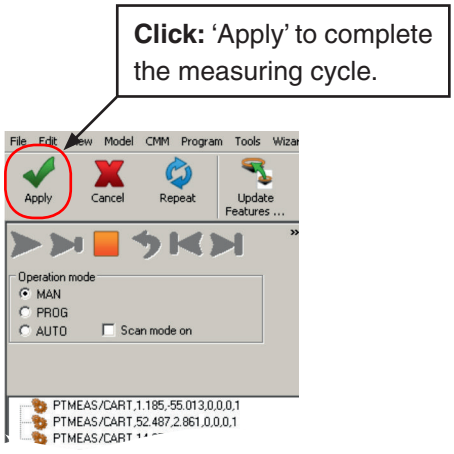
The top face can now be measured:



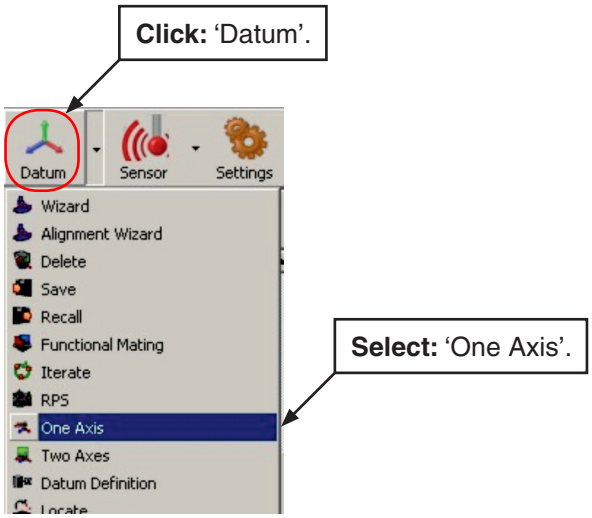


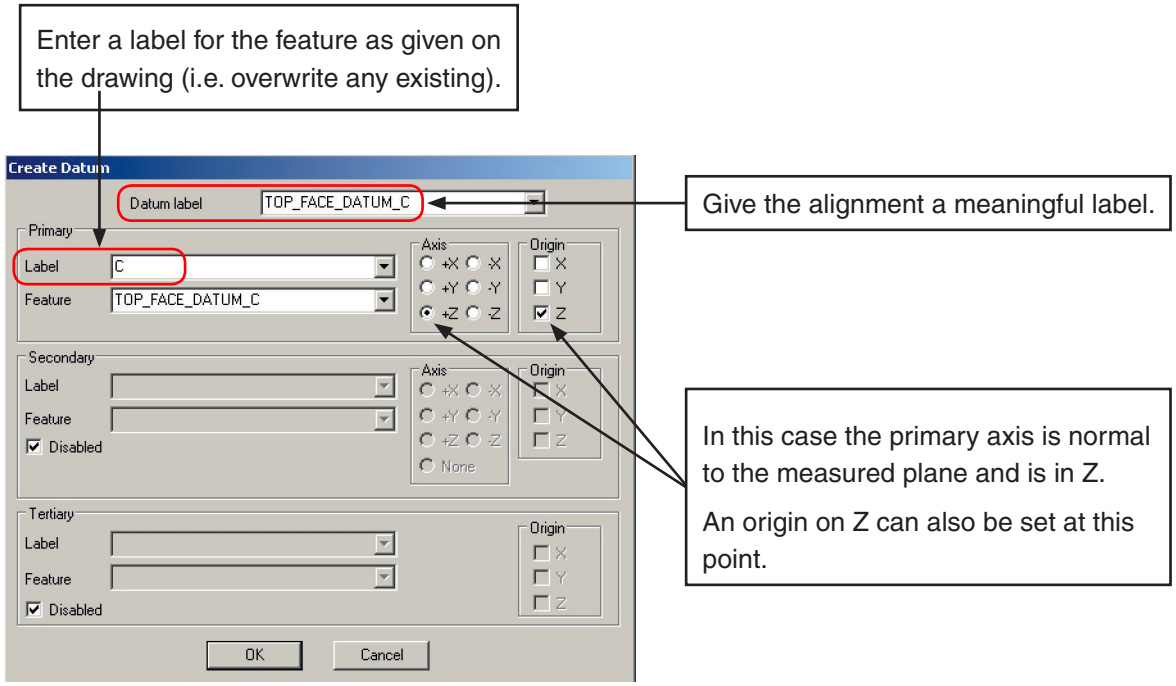
Take eight points on the plane:



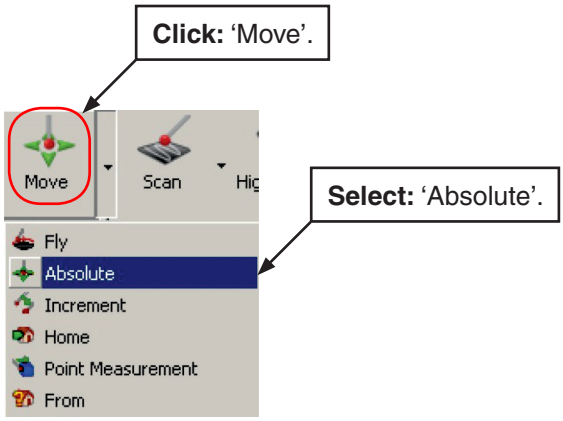


With the plane measured a primary datum can be created:

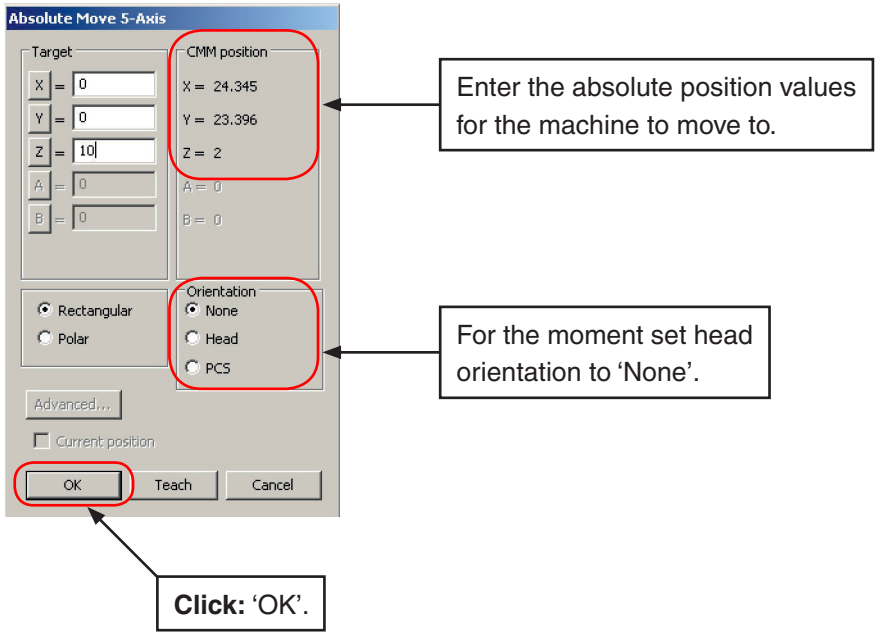




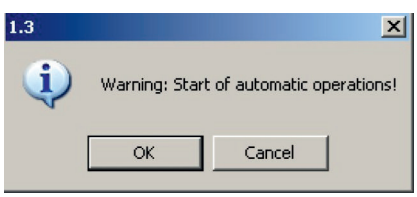
Now move the machine to an ‘Absolute’ position above the part origin, ready to measure the next feature.



GUIDANCE NOTE: An ‘absolute’ move defines the end point of a move rather than the direction and distance.



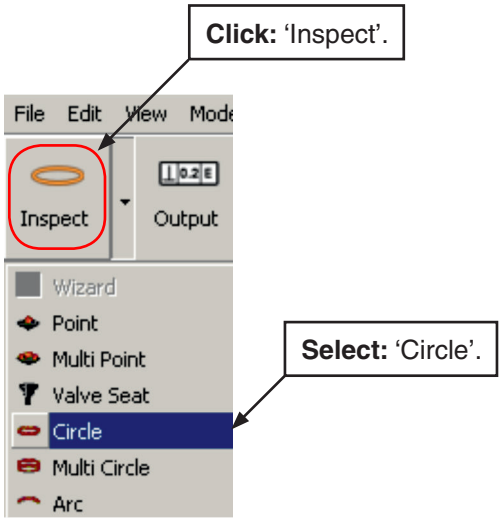
NOTE: Clicking ‘Teach’ reads the current machine position and updates all ‘target’ fields. Clicking on ‘X’, ‘Y’ or ‘Z’ updates only the ‘target’ field associated with that axis.

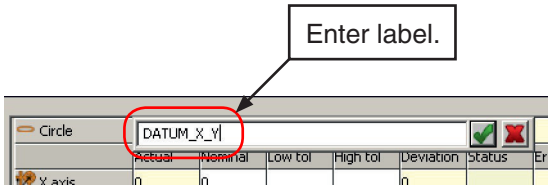


The probe will then move.

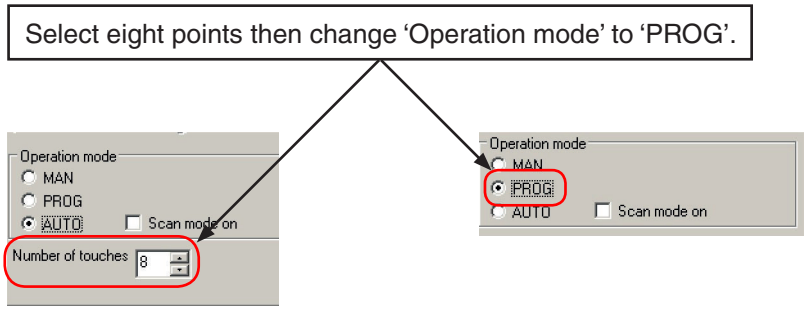
4 Measuring circles in ‘Program (CNC)’ mode

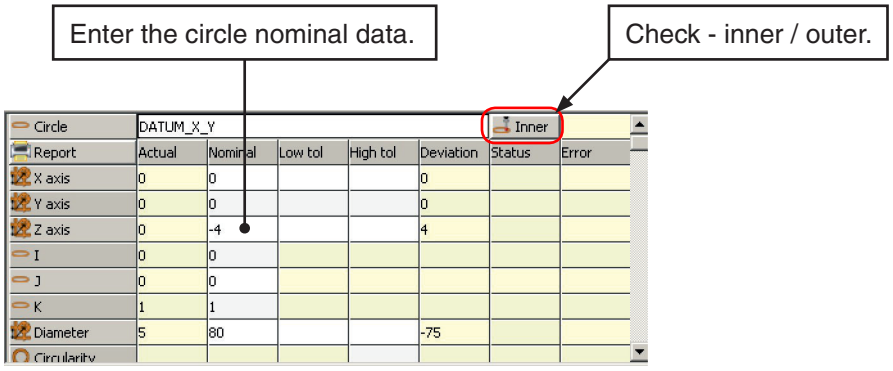
As in earlier manual alignments, the centre of the large bore on the training block will be used as the origin. As such, it must also be measured in ‘Program (CNC)’ mode.

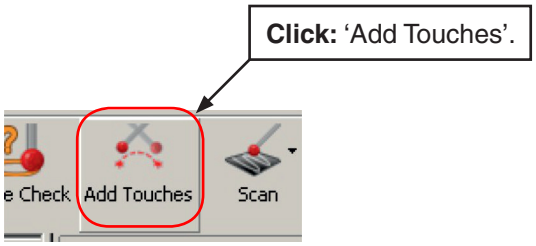


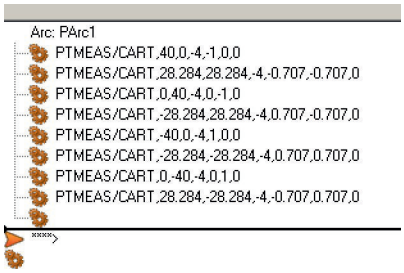


Since there is already a provisional alignment, the drawing dimensions / nominals can be used to create the points to measure the feature.





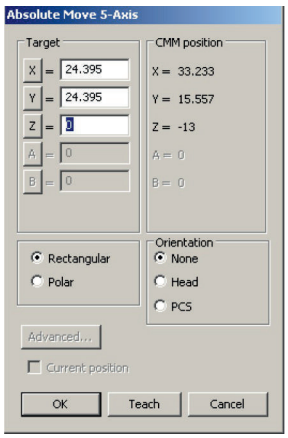




Select: ‘Apply’ to complete the measuring cycle.

The circle will then be measured. Again, the probe needs to be moved out of the feature to prevent collision when moving to measure the next feature.

Click: ‘Move’ then select ‘Absolute’

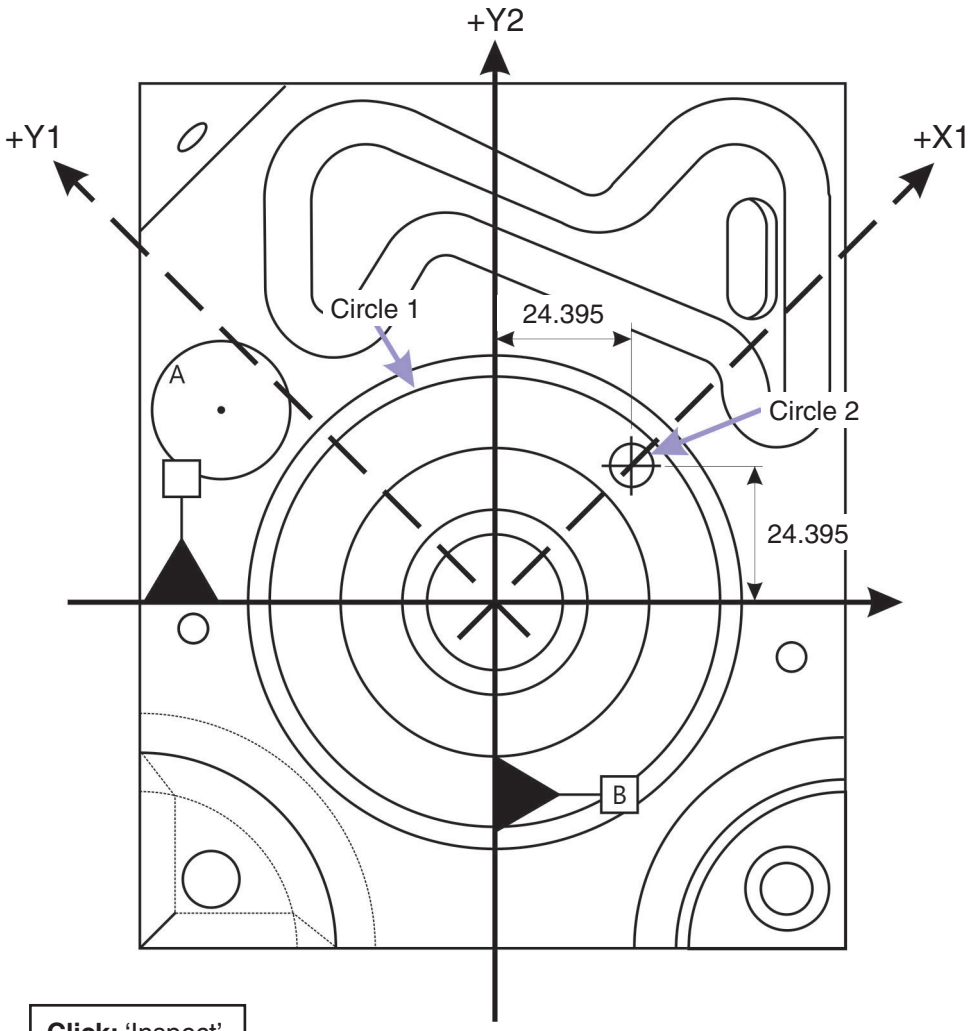


Enter the co-ordinates to move the probe to a position above the circle to inspect the next feature.

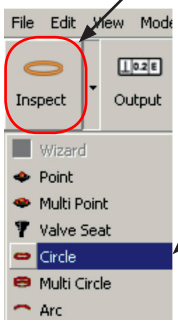
OR

Use the MCU to manually place the probe and then press ‘Take Point’.

Next, a hole on the PCD will be measured. In this tutorial, the PCD hole labelled ‘circle 2’ on the graphic below will be used:

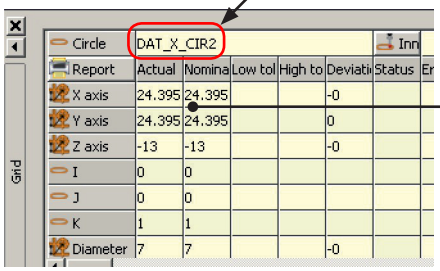


Click: ‘Inspect’.

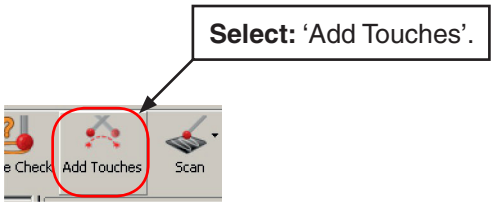


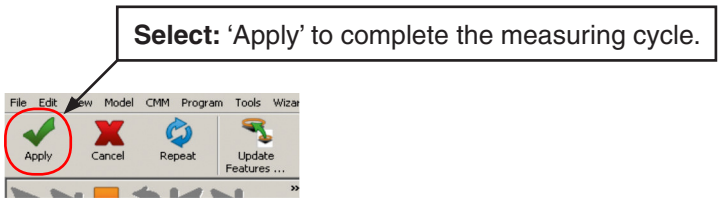
Select: ‘Circle’.

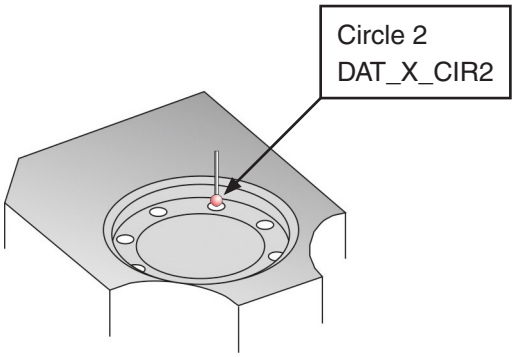
Enter label.



Enter the circle nominal data.

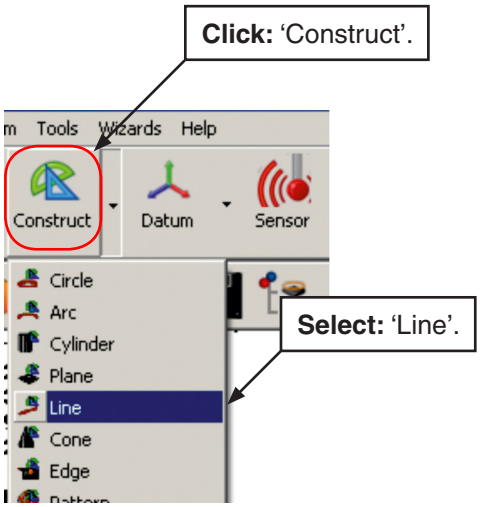


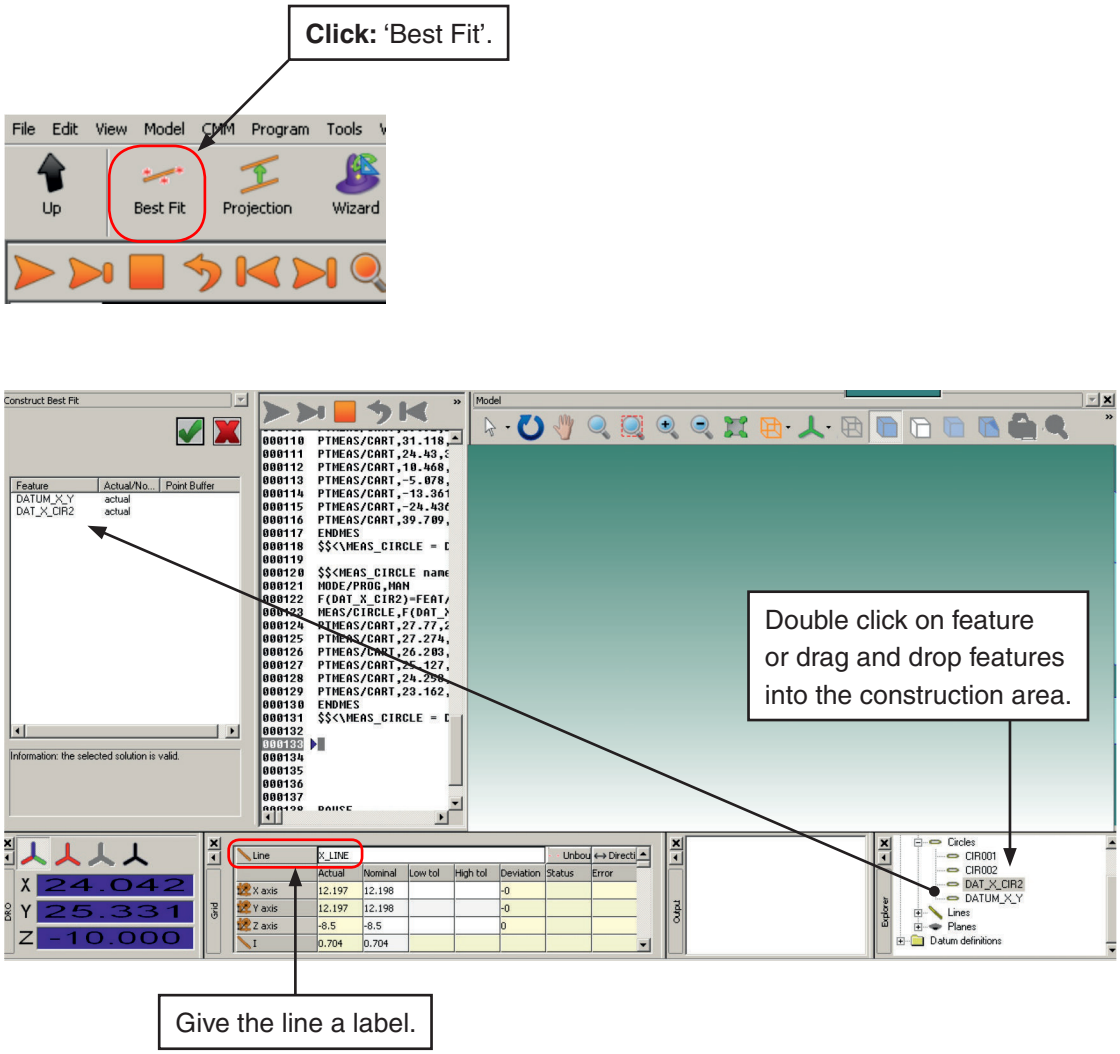




Use the handbox to move probe out of the circle and click ‘Take Point’ to create a GOTO.

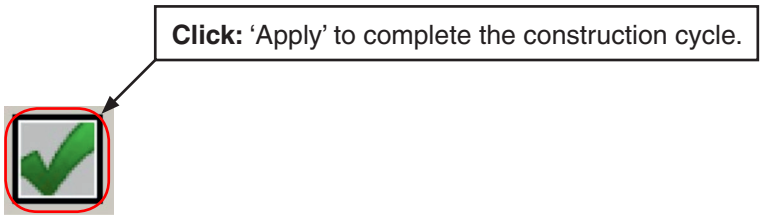
Next, a line will be constructed between the centres of the two measured holes. This feature will then be used to create the datum.





Make a note of the order the holes have been inserted in the construction window, i.e. DATUM_X_Y to DAT_X_CIR2 will give a positive direction and DAT_X_CIR2 to DATUM_X_Y will give a negative direction.

This is important when selecting the axis direction for alignment.



5 Creating a three axis datum

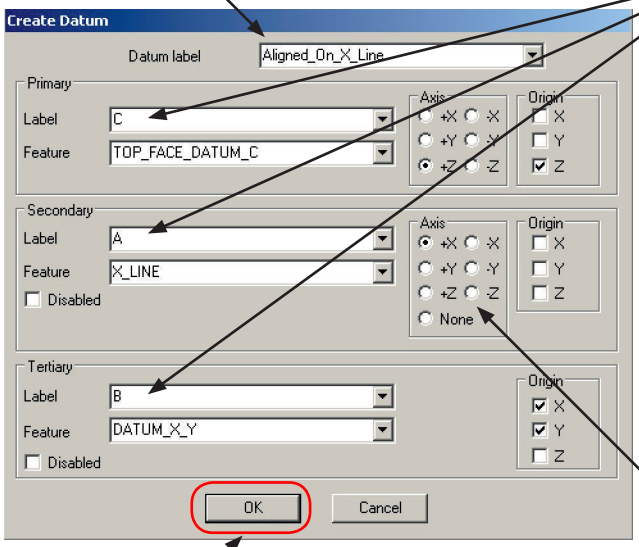
The three axis datum can now be created:

Click: 'Datum'.

Select: 'Three Axes'.

Assign a label

Enter desired labels to match the drawing:



In this case TOP_FACE_DATUM_C is the PRIMARY AXIS [+Z]
On drawing datum C.

X_LINE is the SECONDARY AXIS [+X] (no origin here)
On drawing datum A

DATUM_X_Y is the TERTIARY Point - origin [X and Y]
On drawing datum B

Click: 'OK' to complete the procedure.

In this case the constructed line lies along the X axis.

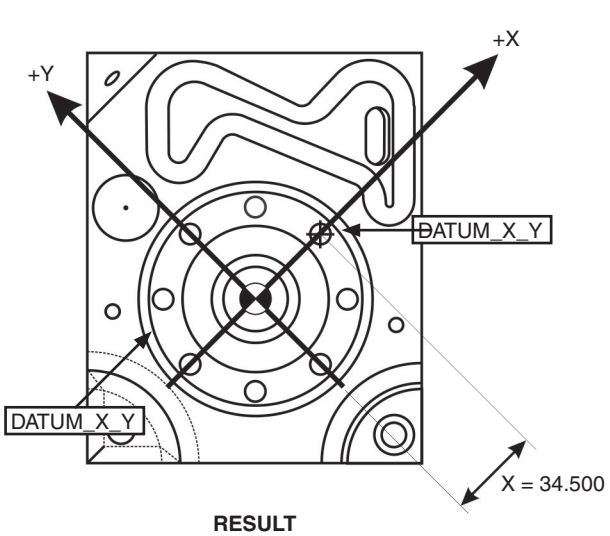
NOTE: There is also have the option of selecting -X or +Y/-Y.

Now check if both circles are in the correct positions.

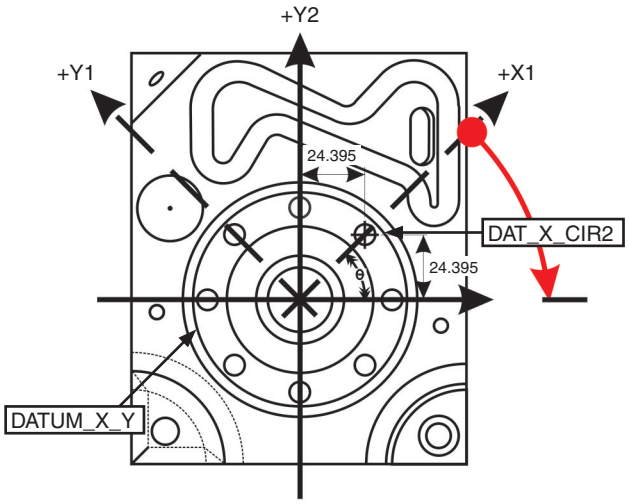
Left mouse click on DATUM_X_Y
The grid will display the result both X and Y should be at zero.

Left mouse click on DAT_X_CIR2
The grid will display the result X = 34.500 : Radial distance From DATUM_X_Y
Y = 0.00.

As shown in the diagram below, the current datum needs to be rotated about the Z axis to achieve the required alignment.



RESULT



Required alignment

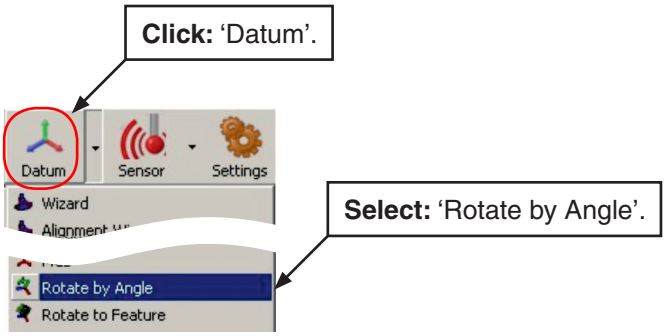
Now make a theoretical rotation using the defined angle through the two co-ordinates given i.e:

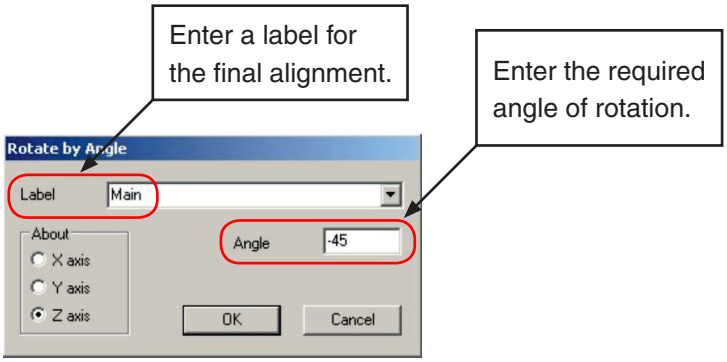
X = 24.395 and Y = 24.395

Angle = Inv Tan (24.395 / 24.395) = 45°

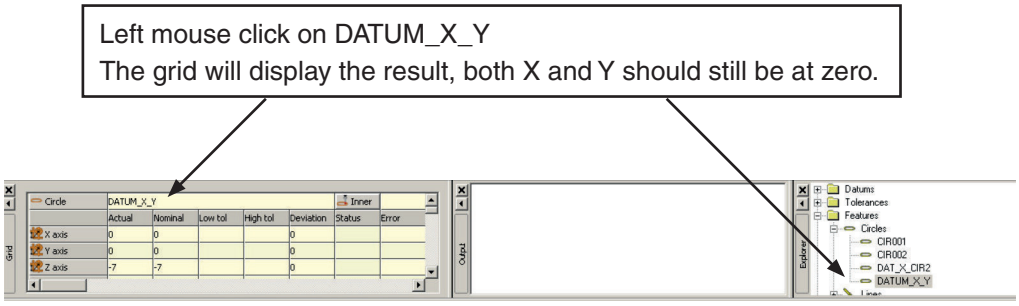
In this case the X and Y axes need to be rotated clockwise by 45°.

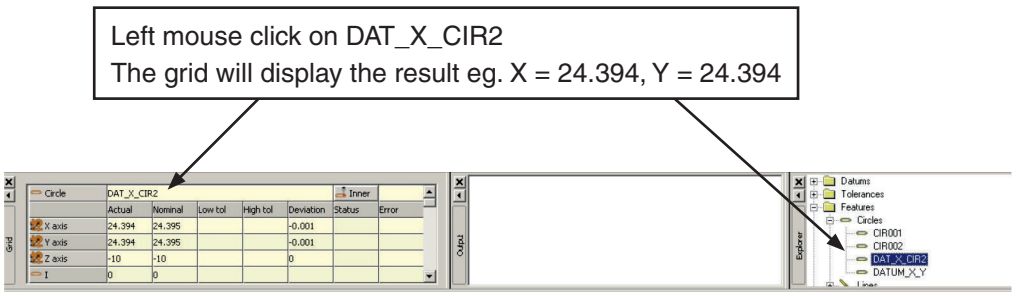
NOTE: -ve angles give clockwise rotation, +ve angles give anti-clockwise rotation.





Now check if both circles are in the correct positions.





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